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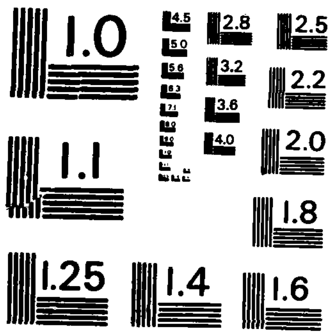

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STUDENT REPORT

THE IMPACT OF FUTURE STRATEGIC DEFENSES ON STRATEGIC STABILITY

MAJOR HENRY L. PUGH, JR. 86-2055

"insights into tomorrow"

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The study provides an analysis of stability issues associated with developing and deploying strategic defenses. Strategic stability is defined in the context of current US and Soviet defense policy, and stability criteria are developed in terms of the abstract concepts of crisis and arms race instabilities and in terms of more pragmatic issues of system survivability and cost effectiveness. The study offers a stability assessment of some generic SDI options based on the criteria above. The study concludes that defensive system survivability is a key stabilizing factor regardless of the level of defensive capability which the SDI process may deliver; while defensive capability is more important in determining whether a nation can adopt a countervailing, war-fighting, or defense emphasis strategy.

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PREFACE

Three central and highly interdependent issues concerning capability, cost, and strategic stability have emerged in the current debate about strategic defenses against ballistic missiles. The United States Strategic Defense Initiative (SDI) addresses two of these issues quite specifically: the technical question of how to achieve various levels of defensive capability and the related question of what it will cost to develop and deploy defensive systems. However, before any deployment decision can be made, the impact of deployment of weaponized SDI systems on the stability of nuclear deterrence must be carefully considered. The purpose of this paper is to provide a systematic analysis of stability issues associated with developing and deploying strategic defenses. As a first step toward assessing the impact of strategic defenses on strategic stability, the author offers a definition of strategic stability in the context of current US and Soviet defense policy. The author develops several criteria for testing the impact of strategic defenses on the stability of nuclear deterrence and reviews recent arguments for and against strategic defenses in light of these stability criteria. Finally, the author offers a stability assessment of some generic strategic defensive systems that might emerge from the SDI process.

The author is grateful to Lieutenant Colonel Richard L. Gullickson for suggesting this research topic and for providing many useful sources as well as his personal insights on the problem. The author also thanks Dr. Anthony K. Hyder of Auburn University for providing additional resource materials for this study.

ABOUT THE AUTHOR

Major Henry L. Pugh, Jr. graduated from the University of Alabama with a bachelor's degree in physics in 1970. He received his doctoral degree in physics from the same institution in 1974. Maj Pugh also received a master's degree in systems management from the University of Southern California in 1981. Since reporting for active duty in 1974, Maj Pugh has served as a researcher, military educator, and program manager in a variety of Air Force assignments. From 1974 to 1977, he was a solid state device analyst, assigned to the Rome Air Development Center, Griffiss AFB, NY, where he studied how device processing methods can affect the reliability of radiation-hardened electronics. From 1977 to 1982, he served as an associate professor and Director of Research in the Air Force Academy's Physics Department. In addition to his administrative and teaching duties in the Physics Department, Maj Pugh conducted basic research on the thermal decomposition of explosives and propellants at the Frank J. Seiler Research Laboratory, an Air Force laboratory collocated at the Air Force Academy. From 1982 to 1985, Maj Pugh was Program Manager for Space Power and Particle Beam Physics at the Air Force Office of Scientific Research (AFOSR), Bolling AFB, DC, where he planned and managed Air Force basic research programs relating to multi-megawatt space prime power systems and particle beam weaponry. During his tour at AFOSR, he participated in the definition and execution of the Strategic Defense Initiative and served part-time in the Strategic Defense Initiative Organization's Directed Energy Office. Maj Pugh is particularly proud of two of his Air Force achievements. In 1982, he was named the Air Force Academy Physics Department's outstanding military educator. In 1985, the Air Force Association recognized his work at AFOSR by presenting him the Theodore von Karman Award, awarded annually for the most outstanding contribution in the field of science and engineering.

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EXECUTIVE SUMMARY

REPORT NUMBER 86-2055

AUTHOR(S) MAJOR HENRY L. PUGH, JR., USAF

TITLE THE IMPACT OF FUTURE STRATEGIC DEFENSES ON STRATEGIC STABILITY

I. Purpose: To provide a systematic analysis of stability issues associated with developing and deploying weaponized Strategic Defense Initiative (SDI) systems.

II. Problem: The capability and cost associated with fielding weaponized SDI systems has received considerable attention in the current debate about strategic defenses. The more profound question of how these defenses will affect strategic stability has received far less attention. A primary obstacle to resolving the stability question is the lack of a generally accepted set of stability criteria against which new defensive systems can be judged.

III. Data: The SDI is a research program, not a program to deploy advanced defensive systems. Its main goal is to build a knowledge base to support a decision in the early 1990s on whether to develop and deploy such advanced defensive systems. Nonetheless, architects of the SDI have already identified practical criteria for fielding weaponized SDI systems which bear directly on the question of strategic stability. These criteria are defensive system survivability and defensive system cost in comparison with the cost of additional offensive weapons to overcome the defense. Weaponized SDI systems could conceivably be used to support a range of nuclear deterrence policies, such as reinforcing countervailing strategies by defending offensive retaliatory forces, strengthening war-fighting strategies by extending protection to a broader range of war-fighting assets,

CONTINUED

or building a new defense emphasis strategy by creating inpenetrable defenses. However, each of these regimes offers different stability challenges in terms of introducing crisis or arms race instabilities. Crisis and arms race instabilities can emerge in the static sense when a country's deterrence posture is altered by deployed strategic defenses, or instabilities can develop in the dynamic sense during the transition from one deterrence posture to another. Proponents of strategic defense argue that strategic defenses enhance deterrence in a general way by increasing the uncertainty for the attacker about achieving his objectives. Opponents of strategic defense argue that strategic defenses are destabilizing because of first strike possibilities, inherent vulnerability of defenses, and expected Soviet responses to US defensive deployments. Approaches not strictly in the technology arena have the potential to alter the impact of stategic defenses on the stability of nuclear deterrence. Two such approaches include the offensive arms build down proposal and a concept for sharing launch warning data called Space Sinai.

IV. Conclusions: Defensive system survivability emerges as a key stabilizing factor regardless of the level of defensive capability which the SDI process may deliver. Certain levels of defensive system capability are essential for a given deterrence posture; but other factors, such as the timing and pace of defensive deployments and estimates of an adversary's intentions, obscure whatever correlation exists between capability and stability. Advances in offensive arms control or cooperation in some aspects of a joint SDI program could moderate arms race and crisis instabilities, but neither should be a precondition for US defensive deployments.

V. Recommendations: Primary consideration should be given to system survivability during the SDI system architecture phase. Multi-layered defenses with loosely coupled, overlapping zones of coverage have the potential to evolve into highly capable, highly survivable systems which do not introduce strong arms race or crisis instabilities into the strategic environment. New ideas for cooperation in the SDI arena, such as the Space Sinai concept for sharing real time launch warning data, should be given greater consideration.

CHAPTER ONE

INTRODUCTION

BACKGROUND

In March of 1983, President Reagan challenged the scientific community of this country ". . . to give us the means of rendering these nuclear weapons impotent and obsolete" (10:A13). Since that time, the debate over the merits of defensive systems has been joined within the defense establishment, in academic circles, in the popular press, in the halls of Congress, and, more recently, at the negotiating table in Geneva. Three central and highly interdependent issues have emerged concerning capability, cost, and stability of nuclear deterrence. Public debate surrounding the United States (US) Strategic Defense Initiative (SDI) has largely focused on the projected capabilities and costs of SDI concepts for ballistic missile defense (BMD). The impact of future strategic defenses on the stability of nuclear deterrence has received much less attention. In the view of the author, the stability question must occupy center stage in the debate surrounding SDI.

The author acknowledges that capability and cost play important roles in an overall assessment of the value of strategic defenses. Clearly, strategic defensive systems must be capable of performing their mission if they are to constitute a credible deterrence to nuclear war. For deterrence to have any meaning, a potential adversary must believe that the system will perform as advertised. A miscalculation of system capabilities by either side could have tragic consequences in the event that deterrence fails. Similarly, a very capable defensive system might not be a viable option if cost/benefit assessments confirm that an adversary can saturate the defensive system with less costly offensive systems. Total system cost is also a factor. If the system cost threatens to absorb too large a fraction of a nation's defense budget and/or gross national product then that state's overall economic viability or its capacity to deter conventional threats may be put at risk.

For the past three years, the author was responsible for the Air Force's basic research programs in space power and particle beam physics and served as the focal point for all Air Force directed energy basic research. Recently, he helped to transfer basic research findings from Air Force programs into the Strategic Defense Initiative Organization's (SDIO) Directed Energy and Innovative Science and Technology Program Offices.

The author's experience convinces him that the research base for strategic defensive technologies is sufficiently robust to expect that militarily interesting and cost effective options will emerge from US SDI programs. Imminent scientists, such as former president of the American Physical Society Wolgang Panofsky (19:35) and Defense Science Board member Richard Garwin (11:35), disagree. They assert that defenses adequate to rid the world of offensive nuclear weapons will never emerge. "Never" is a long time; and military history abounds with examples of the power of new technology to introduce unexpected capabilities into the dynamic competition between defenses and offenses across the spectrum of military conflict. Critics assail DOD estimates of weaponized SDI costs, but such criticism must also be put in perspective. Defense analyst Colin Gray has asked what value Americans should assign to the unique quality and quantity of protection afforded by a weaponized SDI (14:40). Gray notes that the critics' estimate of $500 billion for a weaponized SDI is just eight percent of the DOD budget over a twenty year period. He points out: "No critic of SDI is going to win a political argument claiming that 8 percent of the defense budget for 20 years is not 'worth' the physical protection of North America" (14:40).

Having summarized the importance of capability and cost in the debate about strategic defenses, what supports the author's assertion that stability issues should take precedence? As the SDI program unfolds over the next five years, the debate over capability and cost will be supplanted by research findings; but the stability issue will remain. It is not self-evident that the transition from an offensive deterrence posture to a posture emphasizing defenses can be performed stably or that the resultant defensive force structure will constitute an enhanced nuclear strategy compared to the situation today. In this paper, the author explores the ramifications of this strategic dilemma.

PROBLEM STATEMENT AND METHODOLOGY

The central question addressed in this paper is as follows: What impact will deployment of weaponized SDI systems by the United States have on the stability of nuclear deterrence? The author's methodology for answering this question is to examine the premises on which current nuclear deterrence is based and to compare these premises to those which come into play when strategic defenses have a significant role. In the process, stability of nuclear deterrence will be defined; and several criteria for testing how strategic defenses affect stability will be developed. The author will summarize recent strategic defense stability arguments and attempt to recast these arguments in terms of stability criteria. Finally, the author will offer a stability assessment of a spectrum of generic strategic defensive systems which might emerge from the SDI process.

The author sees two benefits to US planners that might accrue from assessing the stability of various generic SDI options. The

current climate in Congress toward defense spending in general and toward the SDI, in particular, places serious constraints on the range of technological options SDIO planners will be able to investigate. An operational set of stability criteria could provide a useful filter for screening SDI options early in the planning process. Clearly, it would be neither cost effective nor in the US national interest to pursue technology options that result in destabilizing strategic scenarios. Finally, there is the possibility that the Soviets might chart a quite different strategic course from the US in pursuit of new defensive capabilities. If one concludes that pursuit of some strategic defense options is destabilizing, then this knowledge might also prove useful in assessing the Soviets' intentions in the strategic defense arena. Because there are a number of misconceptions about the goals and organization of the US SDI program, the author will briefly describe the US program in Chapter Two of this paper.

CHAPTER TWO

THE US SDI PROGRAM

The formation of the SDI in January of 1984 served to energize the debate about the role of strategic defenses. It is somewhat surprising that two years later, after numerous statements by the Reagan administration, the public is still confused about the goals and structure of the organization created to implement the SDI. Since the most recent Soviet arms control position is that dissolution of the SDI is a precondition to any arms control agreement, it is important to understand exactly what the US would be trading away by dissolving the SDI.

SDI OVERVIEW

The 1985 SDIO Report to Congress on the Strategic Defense Initiative described SDI as ". . . a comprehensive program established to explore and demonstrate key technologies associated with concepts for defense against ballistic missiles" (27:3). The SDIO is organized along functional lines in five key technology areas: (1) surveillance, acquisition, tracking, and kill assessment; (2) directed energy weapons (DEW) technologies; (3) kinetic energy weapons (KEW) technologies; (4) systems concepts and battle management; and (5) survivability, lethality, and key technologies (27:4). These technology areas were being explored by a variety of DOD agencies prior to 1984, but the formation of the SDIO provided closer coordination of on-going research efforts. SDIO officials have stressed that the SDI is a research program, not a program to deploy advanced defensive systems, and that all research efforts within the SDI must be fully compliant with US treaty obligations (27:7). A January 1985 White House pamphlet emphasized the primary goal of the SDI: "The SDI research program will provide to a future President and a future Congress the technical knowledge to support a decision in the early 1990s on whether to develop and deploy such advanced defensive systems" (27:8).

SDI planners see their research task as having three main thrusts: first, to validate the most mature technologies to provide initial strategic defense options; second, to demonstrate the feasibility of new technologies for advanced defense options; and third, to promote research innovation that could lead to eventual elimination of the ballistic missile threat (27:9-10). The program is expected to evolve through four phases, with major program decisions at the end of each phase. The four phases are the research phase, extending into the early 1990s; the systems development or full-scale development phase, beginning in the

early 1990s; a transition phase of incremental deployment of defensive systems; and a final phase involving completely deployed, highly effective multi-layered defenses (27:10).

KEY FUNCTIONS OF BALLISTIC MISSILE DEFENSE

Dr Gerold Yonas, Chief Scientist and Acting Deputy Director of the SDIO, recently described the technical challenge of BMD as follows: "An effective defense against a massive missile attack would require multiple tiers of defense, countering the offense at each phase so that the system would allow only a small fraction of the warheads to strike" (23:28). The four broad phases in the flight trajectory of an intercontinental ballistic missile (ICBM) are the boost phase, during which the first and second stage engines are burning; a post-boost phase, during which multiple reentry vehicles (RVs) and penetration aids (penaids) are deployed from the post-boost vehicle; a mid-course phase, in which RVs and penaids travel ballistically outside the atmosphere; and a terminal phase in which RVs and penaids reenter the atmosphere (27:15). A capable defense must perform certain key functions: rapid and reliable warning of attack and release of defense assets for engagement, efficient intercept of the booster and post-boost vehicle, efficient discrimination of RVs and penaids in the post-boost and mid-course phases, birth to death tracking of all objects in the threat cloud, low cost mid-course intercept, high endoatmospheric terminal intercept, excellent battle management and communications, and timely kill assessment in all phases. (27:15-16). Each of these functions offers tremendous challenges, but promising technologies which address these challenges have been identified and are actively being pursued by the SDIO. Examples of these new technologies include the kinetic energy weapon concept for terminal defense known as the Homing Overlay Experiment, advanced infrared sensors for identifying and tracking space objects, new radar capabilities, new concepts for distributed computing, and recent advances in high power laser and particle beam technologies (28:3-22).

THE NITZE CRITERIA

The architects of the SDI are charged with providing the knowledge base to support a decision on whether to develop and deploy strategic defenses. What should form the basis for that decision? Ambassador Paul Nitze, Special Adviser to the President and to the Secretary of State on Arms Control Matters, has put forward two criteria to judge the feasibility of new technologies.

> They [new technologies] must produce defensive systems that are reasonably survivable; if not, the defenses themselves could be tempting targets for a first strike. This would decrease rather than enhance stability. . . . New defensive systems must also be cost effective

> at the margin -- that is, it must be cheaper to add additional defensive capability than it is for the other side to add the offensive capability to overcome the defense. If this criterion is not met, the defensive systems could encourage a proliferation of countermeasures and additional offensive weapons to overcome deployed defenses, instead of a redirection of effort from defense to offense. . . . If the new technologies cannot meet the standards we have set and, thus, not contribute to enhancing stability, we would not deploy them (25:6).

Ambassador Nitze's rather pragmatic criteria of survivability and cost effectiveness at the margin provide a starting point for a broader discussion of the nature of deterrence, a definition of strategic stability, and the contribution of defenses to strategic stability.

CHAPTER THREE

THE EVOLUTION OF NUCLEAR STRATEGY

The SDI was introduced into the current nuclear strategic arena primarily because US leaders had a growing dissatisfaction with US nuclear strategic posture in comparison with the Soviets. Growing tensions in US strategic doctrine have forced a reassessment of the roles of nuclear forces and have raised doubts about whether present and projected US force structure will be adequate to meet national security goals. In this chapter, the author reviews the evolution of US and Soviet nuclear strategic thinking, defines strategic stability and develops stability criteria based on how changes in nuclear strategy affect international arms competition and crisis resolution. Finally, the author examines the forces propelling US leaders toward greater interest in defense.

DETERRENCE AND NUCLEAR STRATEGY

Leon Sloss, a national security consultant specializing in nuclear policy, has described three functions of nuclear forces: (1) to deter a country's adversaries, (2) to assure one's allies of some degree of protection from nuclear exchanges, and (3) to defend one's country in the event that deterrence fails (2:25). Deterrence derives from the perception by an adversary that his opponent has the will and means to take an unacceptable counteraction to any contemplated attack, thereby preventing the attack (3:xiii). If deterrence fails, a country has no option but to fall back on whatever war-fighting or defensive capabilities it can muster. Since the inception of nuclear competition between the US and the USSR, the US has relied on a "deterrence only" strategy. Originally this strategy was one of "minimum deterrence", that is, the capability to threaten targets of value such as cities or industries. This concept has evolved into a "countervailing strategy" in which military forces and leadership are threatened in addition to the cities and industries. Countervailing strategists view minimum deterrence as insufficient to extend credible protection to US allies. Countervailing strategy requires US forces sufficiently survivable to ensure retaliatory strikes against many preplanned targets (2:37-38). The role of defenses in a countervailing strategy would be to assure survivability of retaliatory forces. Defense analyst Donald Snow (4:22) and others (3:98-99, 15:17, 16:258) suggest that the Soviets have chosen a different strategic pathway towards deterrence, based on avoiding nuclear war by gaining the ability to fight and win a nuclear war. This war-fighting strategy emphasizes the effective military use of

nuclear weapons to end a conflict on favorable terms and includes defense of military and civilian assets. As Sloss points out, "The deterrent mechanism of war-fighting strategies is a credible capacity to deny an adversary the attainment of his political or military objectives of war" (2:41). President Reagan has espoused as the ultimate goal of the SDI an alternative strategy which Sloss calls "defense emphasis" (2:44). A defense emphasis strategy would make current deterrence concepts obsolete by limiting strategic offensive forces and by expanding and improving strategic defense. Deterrence in the defense emphasis scheme relies on the following: "The would-be attacker will be discouraged from attacking by the prospect of a militarily poor or uncertain outcome, rather than by the threat of retaliation" (2:44). The deterrence mechanisms for countervailing, war-fighting, and defense emphasis strategies differ markedly; but all three mechanisms permit some role for strategic defenses. The countervailing and war-fighting strategies, in the absence of significant defenses, have a track record to judge the amount of stability they introduce into the strategic arena. The impact of a defense emphasis strategy on stable deterrence is untested.

STRATEGIC STABILITY

What is meant by stability in the context of nuclear strategy? Stability is ". . . a situation in the overall relation of forces between two adversaries which leads them to conclude that any attempt to settle their conflict by military means would clearly constitute a risk of calculably unacceptable proportions" (3:xviii). Stability is an integral part of deterrence. Stable deterrence is ". . . a situation between two nuclear adversaries in which neither has the capacity or incentive to launch a first strike against the other" (3:xviii). The facet of this definition relating to capacity or force structure has been called "arms race stability"; while the facet relating to incentive in the domestic and international environment is often called "crisis stability" (2:28). Changing force structure and force capability can trigger arms race instabilities, while perceived vulnerability to attack, degradation of command and control functions, or first strike capabilities can trigger crisis instabilities. Strategic stability has both a static and a dynamic component. In the static sense, it is necessary, but not sufficient for strategic planners to determine that a change in strategy results in a more stable condition than initially. Perturbations in the strategic relationship during the transition from one deterrence mode to another, the dynamic component of stability, must also be considered.

STABILITY CRITERIA

The stability considerations above suggest several criteria for gauging whether a change in US strategy from countervailing strategy to defense emphasis is stabilizing or destabilizing. In

a static sense, is the status quo stable in terms of crisis or arms race instabilities and will a defense emphasis scenario be more stable? In a dynamic sense, are the perturbations introduced during the transition from offensive to defensive deterrence sufficient to trigger crisis instabilities or arms race instabilitites? Finally, if specific sources of instability are present, either in the static or the dynamic sense, to what extent can they be removed and still accomplish a change in strategy to defense emphasis? In the next two chapters, Ambassador Nitze's very pragmatic concerns about survivability and cost effectiveness at the margin are merged with the more theoretical constructs of arms race and crisis instabilities in an attempt to determine what impact US deployment of weaponized SDI systems will have on the stability of nuclear deterrence.

FORCES FOR CHANGE

How do defense experts view the status quo in terms of strategic stability? SDI advocate and former national security adviser Zbigniew Brzezinski writing in The New Republic expresses concern about the trend toward first strike weapons in the arsenals of both sides. According to Brzezinski, "This is not to argue that the Soviets (or the United States) are likely or certain to launch a first strike. It is simply to say that the nuclear relationship is growing more precarious" (9:17). Another SDI advocate, former Secretary of the Air Force Hans Mark, writes:

> In the long run, it probably will not be technically feasible to deploy nuclear forces in such a way that they can survive a surprise attack . . . . Therefore new steps must be taken to maintain strategic stability, and the application of new techniques is necessary to accomplish that end (18:11-12).

Former Secretary of Defense Harold Brown, a critic of the SDI program, counters these perspectives by saying, "The expert judgment, which this author shares, is that the stability of deterrence is less precarious than the public thinks it is" (8:59). Other authors critical of SDI echo former Secretary Brown's sentiment (12:31; 20:249-250).

Sharply divided opinion about the stability of the status quo, which in turn spills over into the debate about strategic defenses, is symptomatic of the building tension in current US strategic doctrine. Congressional defense analyst Ashton Carter identifies five major contributions to this mounting tension: first, the theoretical benefits of a more differentiated strategic posture between minimum deterrence and war fighting; second, growing frustration with the moral and political implications of the "mutual hostage" aspects of offensive deterrence; third, concern about political dynamics in the Soviet Union and about arms competition; fourth, concern about defending the homeland versus defending allies; and finally, concern about the relative roles of nuclear and conventional forces for

national security (2:16). Donald Snow adds a sixth cause for the mounting strategic tensions, the trend for technology to drive strategy, first toward improved offensive capabilities in the 1960s and 1970s and now toward improved defensive capabilities as embodied in US and Soviet ballistic missile research and development programs (4:27). But will this new strategic direction enhance or degrade nuclear strategic stability?

CHAPTER FOUR

STABILITY IN THE CONTEXT OF STRATEGIC DEFENSE

The lively debate spawned by the introduction of the SDI has produced a range of arguments concerning the advantages and disadvantages of adopting a defense emphasis strategy. In the author's view, arguments dealing strictly with technical feasibility or cost are interesting; but they should be tabled until the SDI research program fulfills its charter by providing a knowledge base more accurately assessing cost and capability. An equally interesting debate about the relative morality of offensive deterrence and defense emphasis strategies is beyond the scope of this report. Instead, in this chapter, stability arguments for and against strategic defenses are summarized and evaluated.

ARGUMENTS IN FAVOR OF STRATEGIC DEFENSE

The argument that strategic defenses reinforce deterrence goes as follows: defenses enhance deterrence by increasing the uncertainty for the attacker about the likelihood of success (4:167; 6:58-59; 21:7-8; 22:229; 26:3). Kenneth Adelman, chief adviser to the Arms Control and Disarmament Agency, calls this argument "the quintessence of deterrence" (7:46). As a corollary to this argument, proponents of strategic defense assert that strategic defenses contribute to deterrence in the transition to defense emphasis by assuring the survival of US retaliatory forces and C3 facilities (3:202-204; 4:80-81; 5:103; 12:26; 22:225). The logic of defending retaliatory forces is appealing. Former Secretary of Defense Brown, not an admirer of the SDI himself, has argued that, under some circumstances, BMD might be needed to preserve land-based ICBM survivability (8:60). Proponents of strategic defense see defenses as contributing to crisis stability in two ways. They argue that the presence of US defenses would provide a strong disincentive to a Soviet first strike (3:205-207). Advocates of strategic defense also contend that leak-proof defenses would dramatically raise the threshold for nuclear exchanges during a crisis (5:106).

ARGUMENTS OPPOSED TO STRATEGIC DEFENSE

Stability arguments against strategic defense target both crisis instability and arms race instability issues and range from the philosophical to the pragmatic. Some opponents of strategic defense believe that deterrence is best reinforced by the certain knowledge that nuclear war would be suicidal (4:91).

Any attempt to remove the mutual hostage effect imposed by offensive deterrence would be destabilizing (21:9-10). Since strategic defenses, coupled with offensive forces, could be used to reinforce the mutual hostage effect by preserving retaliatory capability, the argument that defenses weaken the mutual hostage effect is not totally compelling. More pragmatic arguments against deployment of strategic defenses invoke first strike scenarios, the perceived vulnerability of defensive systems, and probable Soviet reactions to SDI.

First strike arguments go as follows: A 99.9% capable defensive system facing 10,000 reentry vehicles will still let 10 nuclear warheads get through. The same defenses would do much better against a ragged retaliatory force which has been drawn down by a first strike (2:7; 3:229; 11:41; 12:54; 17:71; 19:40). Another first strike scenario deals with the transition period before defenses are fully operational. An adversary witnessing the phased buildup of opposing defensive forces might be tempted to use his offensive forces rather than risk leaving them useless (11:41; 21:9-10).

First strike arguments are often coupled with vulnerability assessments. The perceived vulnerability of deployed strategic defenses (the static component of stability) and defensive vulnerability during the transition to defense emphasis (the dynamic component of stability) are viewed as major destabilizing factors (6:58-59; 11:41). The validity of vulnerability arguments is difficult to assess because such arguments usually contain implicit assumptions about future system capabilities or basing modes. For example, one analyst asserts that a US strategic defense system would have the same vulnerability as US C3 assets. He couples his vulnerability assessment with a first strike argument (17:70). Retired Air Force Brigadier General Toomay, a strong advocate of ground-based defenses to protect ICBMs, is highly critical of space-based BMD. In his view, the vulnerability of space-based defenses, especially in the co-presence of an adversary's space-based BMD, provides strong incentives for striking first, thereby giving the attacker "global hegemony in a matter of minutes" (22:232-233). The anti-satellite (ASAT) potential of future BMD systems is an example of the difficulty of totally excluding performance considerations from discussions of stability. It is difficult for the author to imagine a promising BMD technology which in its early stages would not have some ASAT capability. As defense analyst David Holloway puts it: "It is one of the dilemmas of BMD development that it will further the development of effective ASAT, which in turn poses a serious threat to BMD" (16:273).

What is the most likely Soviet response to a weaponized SDI? Critics of SDI see in the Soviet response a strong potential for arms race instabilities (11:41; 17:68-70). The Soviets could upgrade their retaliatory forces in an attempt to give themselves a capability to saturate US defenses, they could develop weapons to counter and possibly attack defenses, or they could build their own BMD. Holloway asserts that the Soviets see

". . . their ability to inflict devastating retaliatory strikes on the United States as one of the basic conditions of Soviet security in the present circumstances" (16:269). For this reason, Holloway suggests that the most likely Soviet response would be to continue to build up its offensive forces. However, there is also ample evidence that the Soviets value and have achieved operational ASAT and BMD capabilities. Soviet ASAT and BMD capabilities were recently documented in an unclassified US DOD and State Department brochure (24:7-23). A case can be made that an arms race in defensive technologies has already begun.

UNRECONCILED DIFFERENCES

The argument that strategic defenses enhance deterrence by enhancing uncertainty for the attacker is difficult to assail. One critic of SDI provides the following line of reasoning for asserting that the uncertainty argument has been overstated: "If both superpowers deployed defenses, an attacker would face greater uncertainty about both the effectiveness of his attack and the effectiveness of the adversary's retaliation. The net effect of defenses is therefore indeterminate" (12:35). Is not that exactly the point proponents of defenses were trying to make? On the other hand, arguments that the defensive transition is a particularly dangerous time for stable deterrence, that defenses create new incentives for a first strike, and that SDI fuels the arms race deserve extended rebuttal. Colin Gray calls the claim that defenses incite first strike opportunities "the mad systems analyst" view of the world. Gray concedes that a first strike would do better against defenses than a second strike, but that the attacker would have no way of knowing what was good enough (13:37). As for the claim that the defensive transition is dangerous for stable deterrence, Gray emphasizes, "The key to maintaining stable deterrence is to ensure that at no point Soviet planners have a plausible theory of victory" (14:44). In Gray's opinion, the SDI is not unique in contributing to the arms race. Gray views SDI as the most recent entrant in the historical competition between offenses and defenses. The important point, in his view, is that SDI shifts the competition in nuclear arms away from offensive forces. Gray's argument appears to assume that the Soviets will choose not to counter US defensive deployments with increased offensive deployments. In the near term this would seem to be wishful thinking. Yet, some constraint on the proliferation of offensive arsenals is considered by proponents and critics of SDI alike as crucial to the ultimate success of a defense emphasis strategy (3:230, 4:117, 14:38, 17:72, 21:11). It is an open question whether constraint on offensive forces can be imposed by the arms control process or by agreement by both sides that defenses will cost less, offer greater military utility, and contribute to a more stable deterrence than offenses.

SOME TENTATIVE CONCLUSIONS ABOUT STABILITY

The operative mechanism by which strategic defenses contribute to deterrence is by increasing uncertainty for the attacker about his chances for success. In a countervailing strategy, this uncertainty stems from the increased survivability of retaliatory forces. In a war-fighting strategy, defenses provide additional uncertainty by denying the attacker other targets which contribute to war fighting, such as national leadership or industrial capacity. In a defense emphasis strategy, the level of uncertainty is increased further by denying the attacker the prospect of sufficient civilian casualties to alter the opponent's will to resist. However, increased uncertainty in the mind of the attacker does not guarantee strategic stability. In addition to creating uncertainty in the mind of the attacker, nuclear strategists must recognize the practical importance of defensive system survivability and cost effectiveness at the margin in evaluating how new defensive technologies contribute to stable deterrence. In terms of crisis instabilities, a premium should be placed on survivability both during the defensive transition and after defensive deployments. In terms of arms race instabilities, cost effectiveness at the margin implies some deterrent capability for defenses at reduced cost in comparison with offenses. In the following chapter, the implications of these stability considerations are examined for some generic SDI options.

CHAPTER FIVE

THE SDI AND STRATEGIC STABILITY

The preceding discussion addressed the impact of strategic defenses in general on the stability of nuclear deterrence. In this chapter, the author looks specifically at the impact of US deployment of weaponized SDI systems on stable nuclear deterrence. The number of technological options and possible defensive scenarios at this early stage in the SDI program makes stability estimates for specific SDI options challenging. However, by treating the problem generically it should be possible to say how strategic stability scales with improved capability or survivability.

For new defensive technologies to contribute to stable deterrence, defensive systems based on these new ideas must create sufficient uncertainty in the mind of an attacker about his chances of success that he decides not to attack. This uncertainty flows from credible capability and survivability of the defense. A highly capable, but vulnerable defense contributes less to stability than a survivable system of more modest capability; but systems with modest capability and limited growth potential offer little hope for transition to a defense emphasis strategy. While systems with inherently limited capabilities could enhance the survivability of offensive retaliatory forces when employed as point defenses, the transition to a defense emphasis strategy would stall without the capacity for area defense of population centers. The unknown Soviet response to SDI severely complicates estimates of desired defensive capability. If new defensive technologies are cost effective at the margin, the US strategic posture could be relatively insensitive to future Soviet actions. The transition to defense would still require careful attention to system survivability to preclude crisis instabilities. In this chapter, the stability implications of generic SDI options at varying levels of capability and survivability are assessed. The chapter concludes with assessments of the stabilizing prospects for some "new ideas" in the SDI arena.

STABILITY AND DEFENSIVE CAPABILITY

What level of strategic stability accrues from a given level of defensive system capability? Is there a threshold in defensive capability below which strategic defenses do not contribute to deterrence? Can a defensive system become so capable that it poses an offensive threat? Defense analysts George Rathjens and Jack Ruina have suggested a methodology for

comparing the stability of systems spanning three broad categories of defensive capability. The three categories include President Reagan's ideal of "perfect" defenses against ballistic missiles, defined as leak-proof protection of large areas; "very good, but less than perfect" defenses, defined by greater than 99% effectiveness against a first strike; and finally, "good to fair" defenses with effectiveness greater than 50% (20:244-247). Defenses with less than 50% effectiveness might add some small uncertainty to the attacker's chances of success; but if the cost of adding additional offensive capability is comparable to that of adding additional defenses (say, within a factor of two), the attacker could still achieve his objectives by saturating the defense. The author sees little potential for enhanced deterrence in defenses with less than 50% effectiveness, based on Ambassador Nitze's criterion that strategic defenses be cost effective at the margin.

Perfect Defenses

The most ardent proponents of strategic defense concede that perfect defenses are an ideal; but it may be possible to approach that ideal incrementally by employing multiple layers of defense. The status of current research is such that the number of layers and the required modes of engagement and interactions among layers for highly capable defenses are not yet defined. If such defenses prove feasible, President Reagan's goal of eliminating offensive nuclear weapons would be in sight. While perfect defenses are crucial elements of a defense emphasis strategy, perfect defenses would also support a war-fighting strategy under some circumstances. Would such highly capable defenses automatically result in strategic stability?

If the first side to field perfect defenses retains significant offensive nuclear forces, then even this ideal case could result in strong crisis instabilities. For example, an adversary who considered himself immune from retaliation might decide to act preemptively to disarm his opponent, or he could seek to dictate the terms of crisis resolution by the threat of a preemptive strike. At the level of grand strategy, such military dominance could also be used to extend economic or political dominance as well. Reckless application of this offensve/defensive capability could be disastrous for the preemptive striker if he has misread the will and capacity of his opponent to resist him by other means.

If both sides achieved perfect strategic defenses simultaneously, the arms race would simply shift to the non-nuclear arena. Given the current asymmetry in conventional force structure and military personnel strength between the US and the Soviet Union, it is sobering to think that perfect strategic defenses would shift the competition to an arena in which the US is perceived to be far less able to compete. However, US inability to compete in the conventional arena should not be taken as a foregone conclusion. The same technologies that would support a perfect or near-perfect strategic defense are likely to

find significant applications in the conventional warfare arena. One can only speculate today whether these new technologies would contribute more to defense or to offense in conventional warfare. It should be noted that the conventional warfare dilemma would surface, even without the SDI, as one of the by-products of offensive arms control negotiations.

Very Good Defenses

Very good, but less than perfect, defenses would not guarantee that arms race instabilities would be dampened, but it is conceivable that cost effectiveness at the margin could drive both sides toward reduced offensive forces. Very good defenses, because of their capacity for damage limitation if deterrence fails, are compatible with current US and Soviet strategic doctrines for countervailing and war fighting, respectively. With clever system architecture and sufficient resources, very good defensive systems might evolve into highly capable systems. However, Rathjens and Ruina worry that the existence of very good defenses could combine with a country's perception of what constitutes acceptable damage to drive crisis instabilities from the standpoint of first strike potential (20:245-246). In the arena of very good defenses, one can also speculate that defensive technologies might emerge with sufficient capability to neutralize ballistic missiles in their silos. Former Secretary of Defense Brown called this "the zeroth layer" or "pre-boost" phase in a multi-layered defense (8:56-57). While "pre-boost" intercept is many orders of magnitude beyond today's state of the art, some space-based kinetic energy and directed energy weapon concepts have the potential to achieve this capability. Such devastating firepower would have impact far beyond the strategic arena; since aircraft, shipping, tanks, and troop emplacements would also be placed at risk by systems which could penetrate hardened silos. So dramatic an advance in technology is without precedent, with the possible exception of the advent of nuclear weaponry. In the revolution in warfare engendered by such systems, stability arguments would be swept aside quickly, just as such arguments were when nuclear weapons were deployed.

Good to Fair Defenses

The category of good to fair defenses offers far less flexibility than very good defenses in terms of what offensive actions can actually be deterred. Such defenses might be deployed for point defense of retaliatory forces or other high value targets, such as national leadership or command and control facilities. To the extent that such defenses reinforce deterrence by blunting offensive counterforce capabilities, good to fair defenses improve crisis stability (4:80-81,167; 5:103). Rathjens and Ruina envision such defenses as driving arms race instabilities as both sides strive for incremental improvements in defense. However, they conclude that good to fair defenses are more stabilizing than very good defenses from a crisis stability perspective because small improvements in defensive capability can be offset by similar small improvements in

offensive capability and vice versa (20:247). One implication of Rathjens'and Ruina's analysis is that if the SDI produces a breakthrough in defensive technology with potential to leapfrog into the very good defense category, there could be advantages, based on stability considerations, to fielding less capable defenses first and letting them evolve into the very good category. Disclosure of the feasibility of a much more capable defensive system than currently fielded might influence one's adversary to pursue a similar course and channel the arms competition toward defenses.

STABILITY AND SURVIVABILITY

Survivability is a key factor for stable deterrence both during the transition to defense and after full deployment of defenses. Will survivability issues drive SDI toward a particular deployment scenario or basing mode? Ground-based defenses offer a wider range of options for self-protection than space-based defenses, chief among these being the ability to harden defensive sites without the mass or volume constraints imposed by space. However, both basing schemes will share equally vulnerable attack warning and C3 systems. Space deployable, or "pop up" systems, which would deploy on warning of an attack, offer survivability comparable to ground-based systems; but neither offers the leverage gained by boost phase intercept using space-based systems. As previously discussed, SDIO analysts conclude that multi-layered defenses are required to achieve highly capable defenses. Multi-layered defenses, especially with overlapping zones of responsibility (redundancy) and with vastly different modes of operation (independent failure modes and vulnerabilities), should also enhance system survivability. A great attraction of appropriately configured multi-layered defenses is that enhanced survivability and enhanced system capability can go hand in hand.

NEW IDEAS FOR ENHANCED STABILITY

As a research program, the SDIO perspective on strategic stability has been essentially technology-oriented. Are there approaches outside the technical arena which could provide enhanced stability during the shift to a defense emphasis strategy? At least two such approaches have been put forward by the Reagan administration: a build down in offenses as defenses build up and the possibility of some joint US and Soviet SDI endeavors.

Arms Control

Offensive arms limitations presently dominate current headlines and the attention of US and Soviet leaders. US policy-makers are on record that a primary goal of SDI is to reduce reliance on offensive weapons (25:6). One option put forward by the Reagan administration would permit offensive force modernization, but in a way that leaves fewer offensive weapons

in place as older weapons are removed from the field. While offenses and defenses have been linked in the SDI debate, Ambassador Nitze points out, "If new defensive technologies are shown to be infeasible, strategically significant offensive reductions would, nonetheless, reduce destabilizing elements in the current strategic equation" (26:3). The Reagan administration's reluctance to trade SDI for Soviet arms concessions reflects the reality that, while there is some synergism between arms control and the SDI, the two processes will proceed independently for the foreseeable future.

Technology-Sharing

The second approach, which has received far less attention than arms control, deals with technology-sharing. When President Reagan first suggested sharing of SDI technologies with the Soviets, he was met with some derision even by proponents of strategic defense (6:60, 13:34). On the surface, the problems with technology-sharing seem insurmountable. US technological leadership has often been used to justify US reentry into the defensive technology arena (26:2). Would it be wise to transfer key technologies to the Soviets which might find unintended applications in Soviet military systems? Is there any way to bring the Soviets into a joint defense endeavor and simultaneously protect these key technologies? The author's experience suggests that the Soviets could contribute significantly to a joint SDI program in several key areas, such as large space-based electric power systems for a variety of station-keeping functions, pulsed power to drive lasers and accelerators, and particle beam ion source and accelerator technologies. Given the mutual distrust between the two parties, could the US expect true partnership with the Soviets in exploring any of these areas?

Formidable as these questions are, a senior member of the SDIO has suggested a possible starting point for US and Soviet SDI collaboration (29:--). Nicknamed Space Sinai after the listening posts which feed attack warning data to both the Egyptians and the Israelis in the Sinai desert, the concept involves sharing real time missile launch data by the US and the Soviets. If both sides possessed accurate and timely launch warning data from an SDI-developed space surveillance system, the opportunity for launch on warning would eliminate first strike opportunities for both sides. Since data, and not technology, would be shared, the Space Sinai concept opens the door for at least some cooperation in the SDI arena. A similar idea was proposed in 1978 during the United Nations General Assembly First Special Session on Disarmament (1:282-4). At that time, the French delegation proposed establishment of an International Satellite Monitoring Agency, which would place satellites in orbit to monitor arms control agreements and to provide timely data to the United Nations during international crises. In 1982, a UN study group recommended the concept and the UN General Assembly endorsed it. The Soviets voted against the proposal, and the US abstained. Adamant Soviet objections to the SDI make

the prospects for any sort of dialogue on the concept of Space Sinai uncertain at best. Space Sinai diffuses some first strike arguments against SDI by making launch on warning technically feasible, but such a system would have to be absolutely fail-safe. The author's view is that the idea deserves serious study as one of the few fresh ideas for enhancing strategic deterrence.

STABILITY ASSESSMENT OF A WEAPONIZED SDI

In this chapter, the author examined how strategic stability might scale with various levels of capability and survivability for generic weaponized SDI systems. He also looked at some non-technical factors in the strategic environment which could also influence how weaponized SDI systems impact strategic stability.

The author concludes that improvements in defensive system capability have more to do with the type of deterrence posture defenses will support than with the inherent stability of that posture. For example, good to fair defenses can play a role in a countervailing strategy but are not robust enough to support a defense emphasis strategy. Very good to perfect defenses could support defense emphasis or war-fighting strategies, and possibly countervailing strategies, depending on the opponent's offensive and defensive force structure. Under some conditions, the relative levels of defensive capability between two adversaries can drive arms race or crisis instabilities. For instance, the timing and pace of defensive deployments, the cost effectiveness of defenses, and estimates of the adversary's intentions all affect strategic stability to varying degrees at any level of capability. The collective effect of such factors can overwhelm any correlation between capability and stability which might otherwise be present.

Survivability of weaponized SDI systems, on the other hand, emerges as an essential stabilizing factor, regardless of the prevailing deterrence posture. Survivability considerations do not preclude certain basing options, for example, space-based systems; but survivability considerations become much more important in any total system architecture that includes space-based systems. Whatever basing modes SDI planners eventually deem necessary to achieve a given deterrence posture, a key to strategic stability will be well-conceived system vulnerability and survivability assessments during the system architecture phase of the SDI.

Finally, political initiatives, such as arms control and the Space Sinai concept, introduce a new dimension to discussions of the stability of weaponized SDI systems. Offensive arms control could attenuate some of the destabilizing features of defensive technologies, but there is a question of timing and tempo in the offensive build down process which could govern the stability of the process. If offensive arms are drawn down dramatically before significant defenses are in place, then first strike arguments and arms race issues would be less relevant to the stability debate.

The Space Sinai concept is stabilizing in the technical sense in that it contributes to survivability, but it also supports stability in an intangible way by fostering greater trust between long-standing adversaries.

CHAPTER SIX

SUMMARY AND RECOMMENDATIONS

SUMMARY

The author's assessment of the impact of US deployment of weaponized SDI systems on strategic stability began by noting that growing tension in current US strategic doctrine has produced strong forces for change. The author's bias based on first hand exposure to emerging defensive technologies is that technology will provide nuclear strategists with some militarily interesting options. However, the stakes are too high to ignore the consequences of strategic instabilities introduced by the transition from one strategic posture to another. In Chapter Two of this paper, the author emphasized that the SDI is a research program and not a plan to deploy defensive forces. It is a problem-solving process to build a knowledge base for future deployment decisions. As the author pointed out in Chapter Three of this paper, adoption of a defense emphasis strategy entails a new way of thinking about deterrence. Instead of relying on the threat of retaliation, defense emphasis strategy relies on convincing the attacker that he faces a militarily poor or uncertain outcome. However, the enhanced uncertainty that defensive systems introduce into the strategic equation works in support of countervailing or war-fighting strategies as well. The author proposed criteria in addition to enhanced uncertainty for judging how the presence of defenses alters strategic stability, both in the static and in the dynamic sense. In the static sense, will the future condition, defense emphasis, be more or less stable than the status quo? In the dynamic sense, will instabilities during the transition to defense emphasis erode stable deterrence? Both the static and the dynamic components of stability can be evaluated by describing how a given strategic posture drives crisis and arms race instabilities. By merging the somewhat abstract concepts of crisis and arms race instabilities with practical considerations of defensive system survivability and cost effectiveness at the margin (the Nitze criteria), the author compared stability arguments for and against strategic defense based on common stability criteria in Chapter Four. In Chapter Five, the author applied these same stability criteria to generic future weaponized SDI systems over a range of systems capabilities and survivabilities to address the research question: What impact will deployment of weaponized SDI systems by the US have on the stability of nuclear deterrence?

The author concluded after surveying general arguments for and against strategic defenses that a premium is placed on

survivability both during the transition to defense emphasis and after strategic defenses are deployed. Survivability emerges as a critical stabilizing factor at whatever level of defensive capability the US might choose to deploy. The impact of increased defensive capability on strategic stability is less clear-cut. Credible defensive systems will need increased levels of capability to support US countervailing strategy as offensive forces grow more vulnerable or to support a future defense emphasis strategy. While increased defensive capabilities can generate new policy options, arms race or crisis instabilities are possible across the spectrum of defensive capabilities from good defenses to highly capable defenses. A very survivable defensive system with modest capability may serve stability better in the transition to defense emphasis than a very capable, less survivable system because it is less of a first strike threat. The transition to a defense emphasis strategy requires that a system with modest capabilities be upgraded incrementally at least to very good status. Advances in arms control or cooperation in the defensive arena have the potential to moderate some destabilizing forces in the current strategic environment, but neither stands as a precondition for US deployment decisions.

RECOMMENDATIONS

The SDI is clear evidence that the US has embarked in a new strategic direction. SDI research will define ultimate system capabilities and corresponding strategic choices. Whether these choices will include a defense emphasis policy or some hybrid policy that retains the threat of retaliation, potential arms race and crisis instabilities will continue to confront defense planners. As SDI planners balance the merits of a wide range of defensive technology options in the initial phases of a funding-limited program, system survivability should be used as a primary constraint on total system architecture, based on stability considerations. A multi-layered defense with overlapping, loosely coupled zones of coverage provides a moderately capable, highly survivable defense. However, careful attention should be paid to system vulnerability induced by common battle management networks among layers of the defense. An important feature of the multi-layered approach is the capacity of each layer to be upgraded independently with each advance in technology so that the defensive system can mature into a highly capable defensive shield. Although it is doubtful that the Soviets would be receptive to any cooperation in the SDI at this time, new ideas such as Space Sinai offer creative alternatives for dealing with stability problems associated with strategic defenses. The author recommends that Space Sinai be given serious consideration by the SDIO.

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